Nourishment Essential Requirement for Bio-Hydrogen Production in Anaerobic Condition

Zahra Shamsizadeh¹, Mohammad Mehralian², Maryam Khashij¹*

¹ Environmental Science and Technology Research Center, Department of Environmental Health Engineering, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.
² Department of Environmental Health Engineering, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

ARTICLE INFO

LETTER TO EDITOR

*Corresponding Author:
Maryam Khashij

Email:
M.khashij@yahoo.com

Tel:
+989364820423


Whereas quantity of fossil fuels is limited, Large-scale production of hydrogen is a necessity for the world. It is concluded that hydrogen is the most promising option in the succession of fuel evolution. Combustion of hydrogen results lower NOx emissions (more than 57-73%) from internal combustion engines, which is environmentally more desirable. It does not produce greenhouse gases; instead it has a high energy yield (142 kJ/g) which is 2.75 times more than that of any fuel. Compared with alternative technology, namely hydrogen production from fossil fuels, biomass and water using chemical, biological process generate large quantities of hydrogen; however, the operation is to some extent difficult. Among biological H₂ production processes such as (photosynthetic hydrogen production and fermentative hydrogen production), the fermentative production has been considered as a viable and effective method. In general, it has some significant advantages compared to photosynthetic hydrogen production and produces hydrogen continuously without light using various kinds of substrates, low cost and finally biogas (H₂) production. Therefore, fermentative hydrogen production has been received increasing attention in recent years. Hydrogen production via fermentation involves facultative or anaerobic bacteria. Microbiological treatment processes require nutrients such as organic substrates, a source of carbon and energy, to sustain growth and to carry out biochemical transformations. Additionally, higher hydrogen yields will most probably be achieved through adding proper nutrients, thereby enhancing catabolic processes. The various nutrients that may establish can either be promoted or inhibited, depending on the adopted operating conditions. To this regard, operational parameters including substrate concentration, temperature, reactor configuration, pH and organic loading rate should be the subject for optimization of process efficiency. These processes are undertaken via different anaerobic bacteria. The characteristics of these microorganisms widely differ from each other with respect to substrates and process conditions.

However, there are several high potential bacteria for...
hydrogen production that nutritional requirement of this bacteria depends on the type of bacteria and experimental conditions. The list of microbial community of interest includes facultative anaerobe species (Enterobacter aerogenes, Enterobacter cloacae IIT-BT 08) and obligate anaerobe species (Clostridium butyricum, Citrobacter spY19, Bacillus coagulans and Clostridium acetobutylicum ATCC 824). Among microbial community, the Gram-positive bacteria of the Clostridium genus are promising, since it has a natural high hydrogen production rate. In addition, it is fast growing and capable of forming endospores, which makes the bacteria easy to handle in industrial application.

At this time, hydrogen production and its use as a fuel are of great significance. Therefore, because of hydrogen yields depended on the nutrient requirement to the bacterial community of Hydrogen production, it is necessary to recognize the most optimal rate of nutrient on operation.

Acknowledgements
This study is conducted with the support of Shahid Sadoughi University of Medical Sciences. Thus, hereby, the authors would like to appreciate the head of Environmental Science and Technology Research Center and all those who have assisted in conducting this study.

This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) license, which permits others to distribute, remix, adapt and build upon this work for commercial use.

References